

# **Environmental Indicators Report**



**DURHAM CITY-COUNTY  
ENVIRONMENTAL AFFAIRS BOARD**

**December 2002**

The Durham City-County Environmental Affairs Board was formed by joint agreement between the City of Durham and the County of Durham. Its citizen volunteer members are appointed by the City Council, the County Board of Commissioners, and the Soil and Water Conservation Board of Supervisors. Among the charges to the Environmental Affairs Board are the following:

- advise the Durham City Council and the Durham County Board of Commissioners on environmental policy;
- educate the public and local officials on environmental issues; and
- perform special studies and projects requested by the City and/or County on environmental questions.

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## INTRODUCTION

Durham County Board of Commissioners Chair Ellen Reckhow has asked the Durham City-County Environmental Affairs Board (EAB) to develop a simple set of environmental indicators that can be used to track environmental conditions within the County from year to year. Such environmental indicators have been developed by numerous communities across the country over the last few years. For example, Wake County and Mecklenburg County recently began producing annual environmental indicator reports.

### *Why should we have environmental indicators?*

Concern about the state of our environment cuts across all sectors of society. A study conducted in Detroit in 1998 documented that 77% of blacks and 70% of whites identified pollution as one of the most important problems facing the country.<sup>1</sup> This is not surprising, in that the deteriorating state of the environment has had a significant impact on public health. For example, between 1980 and 1994, asthma prevalence in the United States increased by 75%.<sup>2</sup>

Environmental indicators can help us gauge how well we are protecting ourselves from health impairment. They can also help us keep track of resource depletion, which appears likely to become a much more serious problem over the next few decades. Natural resources are the foundation of our economic well-being, and economic development depends upon intelligent management of these resources. Moreover, environmental indicators can help us track how we are affecting weather and other natural systems that can cause serious damage, such as floods.

Local environmental indicators won't track all the important measures of planetary environmental health, but they can track important local environmental problems, their causes, and strategies for improvement. Indicators will give us a sense of whether the trend is good and will highlight the need for new action if it is not.

In short, environmental indicators can be an educational, motivational, and planning tool for citizens and policy makers.

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<sup>1</sup> Mohai, P. and Bunyan Bryant (1998), "Is There a 'Race' Effect on Concern for Environmental Quality?" 62 *Public Opinion Quarterly* 475-505.

<sup>2</sup> *Data Fact Sheet: Asthma Statistics*, National Heart, Lung, and Blood Institute, National Institutes of Health, [www.nhlbi.nih.gov/health/prof/lung/asthma/asthsta.pdf](http://www.nhlbi.nih.gov/health/prof/lung/asthma/asthsta.pdf).

### *How were the indicators chosen?*

The EAB chose several environmental categories and developed proposed indicators within each of these categories. The initial selected categories were air quality, water quality, solid waste, toxics, biodiversity, transportation, public health, public education, land use, and implementation of the 2020 Comprehensive Plan. Energy was later added to this list. The land use category was subsequently deleted due to overlap with other categories, and the comprehensive plan category was eliminated because the comprehensive plan was undergoing revision. The public health and public education categories were reluctantly omitted from the final list of indicators due to the inability to obtain good data.

The intent was to produce a set of indicators such that each one could be described as follows:

- **valid**—i.e., measures the quality sought to be measured;
- **reliable**—i.e., is accurate and exhibits little variation due to subjectivity or use by different individuals;
- **understandable**—i.e., has an unmistakably clear meaning;
- **timely**—i.e., can be compiled and distributed promptly enough to be of value to operating managers, policymakers, and the public;
- **comprehensive**—i.e., addresses the major issues;
- **nonredundant**—i.e., contributes distinctive information;
- **easily obtained**—i.e., is readily available and currently being collected or compiled by reliable sources;
- **focused on controllable measures**—i.e., emphasizes conditions that are controllable by policy initiatives or management action.

The EAB developed an initial long list of indicators. Individual EAB members then conferred with City and County staff in relevant departments with the objective of paring down the list to no more than three indicators per category. The goal was a list short enough to engage the public's attention and to allow comparisons from year to year without requiring the reader to look at a huge amount of data. The resulting list of indicators was circulated among local environmental groups and relevant government agencies for comment, then adjusted to produce the list of indicators presented in this document.

A list of all the indicators considered by the EAB appears in the Appendix. Some of these were rejected because it was determined they were not as good as other indicators. Other indicators were deemed excellent indicators, but data were not easily available. Still others were deemed perfectly good indicators for which data were available, but they were rejected merely to keep the overall list of indicators to a manageable size.

For the selected indicators, the EAB presents in this document a description of each indicator and its value for the base year, which was 2001 to the extent feasible. Providing the base year

data served not only to provide an initial value but to demonstrate that data for each indicator were indeed readily available.

### ***What cautions come with these indicators?***

As the EAB developed this set of environmental indicators, it discovered several instances where data do not currently exist for what would be excellent indicators. For example, a database of acres of protected open space is under development but not yet available in a form that would provide good data for an indicator. Another example of currently unavailable information is respiratory illnesses related to environmental factors. The proposed indicators in this document should therefore be viewed as a preliminary set of indicators that should evolve as better data are developed.

These environmental indicators are also no substitute for a comprehensive set of coordinated goals, policies, and actions steps to foster and maintain a healthy environment within Durham County. Without a conscientious approach to addressing environmental issues more comprehensively, these indicators could provide a misleading message that such indicators are sufficient to measure how well we are doing. The EAB desires to underscore the limits of these indicators. They were developed by a volunteer board with few resources as an example of indicators currently available. They are best viewed as something that can serve on an interim basis while environmental indicators are developed to better reflect achievement regarding more comprehensive goals, policies, and action steps.

It should also be noted that these indicators are not meant as “sustainability” indicators, which would include measures related to economic and social concerns as well as environmental concerns.

### ***What are the next steps?***

The EAB recommends that the City and County establish a coordinated program for setting goals, examining policies, and developing action steps regarding environmental health that can then be translated into a more meaningful set of indicators that would reflect these goals, policies, and action steps.

An example of the type of goal-setting that should be developed on a more comprehensive basis for numerous issues is the *Greenhouse Gas Emissions Local Action Plan for the City of Durham*.<sup>3</sup> This plan was the result of a resolution adopted by the City of Durham to develop an action plan for greenhouse gas emissions. The resulting plan

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<sup>3</sup> Submitted to the City in October 1999 by the Greenhouse Gas Emission Task Force, the International Council for Local Environmental Initiatives, and CH2M HILL.

- inventories greenhouse gas emissions from Durham County during the base year 1998;
- forecasts greenhouse gas emissions up to the target year 2025;
- suggests a target reduction in greenhouse gas emissions in 2025 compared with 1998; and
- identifies actions the City and the community could take to reduce greenhouse gas emissions between now and 2025.

The plan is a good model in that it suggests actions regarding internal City department practices as well as actions to be taken by businesses and residents.

The goals set in the plan have not, however, been translated into adopted policies, action steps, or indicators of progress. This is something that could be accomplished in a coordinated City and County effort as part of the next steps recommended by the EAB.

The longterm process recommended by the EAB will require input from throughout the community regarding environmental justice and both short-term and long-term environmental concerns. It will also require developing a process of continuous evaluation so as to ensure that any resulting environmental indicators maintain their significance over time.

As a volunteer board, the EAB does not have the resources to be responsible for such an undertaking. The EAB would like to contribute to the effort, but there are also other groups in the community that have interest and expertise to offer. For example, there are groups of environmental professionals from local universities and federal environmental agencies that meet regularly and might be enlisted to assist with this effort. Similarly, there are numerous environmental and community groups that would probably be interested in participating. What is currently missing is a local government presence to tie these groups together and enlist them in the effort to develop goals, policies, action steps, and indicators of progress. The EAB suggests that a City, a County, or a joint City/County staff person be assigned to manage this process. This staff person might be able to attract grant funding to bring additional resources to the process.

A process for approaching environmental indicators might involve the following steps:

- ***Begin with consensus on the components of a healthy environment.*** For example, some of these might be healthy air, clean water, and diverse wildlife.
- ***Identify the major problems affecting each component, along with the sources of those problems.*** For example, vehicle emissions are a problem with regard to healthy air, and some of the sources of this problem are a high number of vehicle miles traveled and use of vehicles with high emission levels per mile traveled.

- ***Prioritize the foregoing problems and their sources.*** The highest priority items would be those with both a significant effect on the environment and a high likelihood of responding to changes in behavior.
- ***Determine desired outcomes for the two dozen or so highest priority problem sources, using target numerical values.*** For example, the total amount of vehicle emissions should produce only x total tons of particulate matter and y total tons of carbon.
- ***Outline some key strategies necessary to achieve each desired outcome.*** For example, reduction in vehicle emissions to target levels could be achieved through people choosing to buy fuel efficient vehicles and driving fewer single-passenger miles.
- ***Define indicators that will monitor problems, causes, and strategies.*** For example, indicators could include actual vehicle emission measurements (problem), vehicle miles traveled (cause), and purchases of alternative fuel vehicles (strategy).
- ***Establish a process for continuous monitoring and improvement of indicators.*** This could be the assignment of a staff person responsible for ensuring that City and County action steps regarding environmental goals are being coordinated.

In the meantime, the EAB recommends that the City and County adopt these proposed environmental indicators and track their progress over the next year or two while additional or other indicators are developed. Relevant City and County departments should be assigned the task of collecting the indicator data and reporting it on an annual basis.



## SUMMARY OF 2001 ENVIRONMENTAL INDICATORS FOR THE CITY OF DURHAM AND DURHAM COUNTY

#	Description	Unit of measurement	Source of data	Goal	2001
<b>Air Quality</b>					
1	Ozone concentrations	Number of times ozone concentrations exceeded 0.08 ppm over an 8-hour period	NC Division of Air Quality	Decrease	8
2	Particulate matter concentrations	Annual arithmetic mean of PM 2.5 concentrations exceeding 15 mg/m3	NC Division of Air Quality	Decrease	15.84
<b>Water Quality</b>					
3	Stream health	Percent of rated streams with benthic macro-invertebrate rating of "good" or "excellent"	NC Division of Water Quality	Increase	29
4	Drinking water quality	Total number of violations of maximum contaminant levels in public water supply	Durham City Env'l Resources Dept.	Decrease/ Maintain	0
5	Wastewater discharge	Annual per capita pounds of nitrogen discharged by public wastewater treatment plants to streams in the county	Durham City Env'l Resources Dept. and Durham Co. Engineering Dept.	Decrease	1.5
<b>Solid Waste</b>					
6	Per capita solid waste disposal	Municipal solid waste and construction and demolition waste originating in Durham County landfilled and incinerated, in tons per capita	NC Solid Waste Section	Decrease	1.07
7	Total solid waste disposal	Municipal solid waste and construction and demolition waste originating in Durham County landfilled and incinerated, in tons	NC Solid Waste Section	Decrease	238,894
8	ISO 14001 certification	Number of employers in Durham County with ISO 14001 certification	NC Div. Of Pollution Prevention and Environmental Assistance	Increase	3
<b>Toxics</b>					
9	Toxics released to the environment	Total pounds of toxics released to the soil, air, and water as reported to the US EPA	US EPA	Decrease	171,251
10	Leaking underground storage tanks	Number of open cases regarding underground storage tank incidents	NC Dept. of Environment and Natural Resources	Decrease	356

(continued on next page)

#	Description	Unit of measurement	Source of data	Goal	2001
<b>Biodiversity</b>					
11	Current information on plant communities	Number of years since last county inventory of plant communities	City/County Planning Department and NC Natural Heritage Program	Decrease	16
12	Current information about animal species	Number of years since last county inventory of amphibians, reptiles, nesting birds, and mammals	City/County Planning Department and NC Natural Heritage Program	Decrease	8
<b>Transportation</b>					
13	Bus ridership	Bus passenger trips per capita	Durham Area Transit Authority	Increase	16.44
14	Bike lane availability	Percent of total bike path miles designated in the current Long-Range Transportation Plan and Trails and Greenways Master Plan that have been built	City/County Planning Department	Increase	6.5
15	Vehicle trip reduction	Percent of covered employers in compliance with Durham's Commute Trip Reduction Program	Triangle Transit Authority	Increase	70
<b>Energy</b>					
16	Solar installations	Total number of solar installations reported as part of Million Solar Roofs initiative	Cooperative Extension Service	Increase	107
17	Alternative fuel vehicles	Number of alternative fuel vehicles registered with the Triangle Clean Cities Program	Triangle Clean Cities Program	Increase	64
18	Alternative fuel sources	Number of public access stationary and mobile refueling stations for alternative fuel vehicles	Triangle Clean Cities Program	Increase	0

## DESCRIPTION OF ENVIRONMENTAL INDICATORS

This section includes a full description of each indicator. Included in the description is the data source, an interpretation of the meaning of the indicator, and, in some instances, weaknesses of the indicator and suggestions for improvement.

### Air Quality

#### **1. Number of times ozone concentrations exceeded 0.08 parts per million (ppm) over an 8-hour period**

Ozone is a gas formed by the interaction of oxides of nitrogen and volatile organic compounds (VOCs). Sunlight and heat are the catalysts for the chemical reaction that produces ozone. Oxides of nitrogen are a byproduct of combustion, and VOCs are produced by manmade and natural sources. While stratospheric ozone protects life from ultraviolet radiation, ground-level ozone can cause respiratory problems and impair the abilities of plants to produce and use food.

The North Carolina Division of Air Quality monitors ground-level ozone layers and, from May to September, issues color-coded ozone forecasts for the Division which help people plan their activities to avoid excessive exposure to ozone. The Division of Air Quality has adopted the proposed federal ozone standard of .08 ppm. Ozone levels over this threshold concentration are believed to be unhealthy.

In 2001, ozone concentrations in Durham exceeded .08 ppm 8 times. It is desirable that this number decrease, though fairly dramatic year to year variations are possible depending on weather conditions.

Detailed information about the source of ozone, its effect on our health, and levels in Durham is available at the Department of Air Quality's web site at [www.daq.state.nc.us](http://www.daq.state.nc.us).

#### **2. Annual arithmetic mean of PM 2.5 concentrations exceeding 15 mg/m<sup>3</sup> (milligrams per cubic meter)**

Particulate matter 2.5 (PM 2.5) refers to a class of airborne pollutants resulting from combustion that is comprised of particles of dust smaller than 2.5 microns in diameter. Above threshold concentrations, these microscopic particles can cause damage to our lungs. North Carolina has adopted the proposed federal threshold standard of 15 milligrams per cubic meter. Concentrations exceeding this amount are considered unhealthful.

The North Carolina Division of Air Quality measures PM 2.5 levels in Durham. In 2000 the annual arithmetic mean of concentrations of PM 2.5 exceeding 15 milligrams per cubic meter was 15.84. It is desirable that this number fall below 15 milligrams per cubic meter and continue to decrease over time.

Again, more detailed information about PM 2.5 is available on the Division of Air Quality web site at [www.daq.state.nc.us](http://www.daq.state.nc.us).

## Water Quality

### **3. Percent of rated streams with benthic macroinvertebrate rating of "good" or "excellent"**

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since many benthic species in a community have life cycles of six months to one year, the effects of short term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community is also sensitive to a wide array of potential pollutant mixtures.

Criteria have been developed to assign bioclassifications ranging from "poor" to "excellent" to each benthic sample from flowing waters. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is not assessed as well by this measure. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal) within North Carolina for freshwater flowing streams.

The City of Durham (Stormwater Services) samples 13 streams in Durham County for macroinvertebrates. Streams were sampled in 2001 and again in 2002 using State of North Carolina protocols. Three additional sites may be added in 2003. Data from the City of Durham (Stormwater Services) indicate that 1 of 13 stream segments was rated "good" in 2001.

The North Carolina Division of Water Quality (DWQ) sampled 4 sites in the Cape Fear River Basin portion of Durham County in 1998; three of those sites were not rated because samples were collected in the winter. DWQ also sampled 7 sites in the Neuse River Basin portion of Durham County in 2000. These are the most recent DWQ data for Durham County streams. No sites in the Cape Fear River Basin were rated "good" or "excellent" by DWQ; 5 of the 7 sites in the Neuse River Basin were rated as "good" or "excellent." (Information is from the 1999 Cape Fear River Basinwide Assessment report by DWQ at

[www.esb.enr.state.nc.us/Basinwide/CPF1999.pdf](http://www.esb.enr.state.nc.us/Basinwide/CPF1999.pdf) and from the 2001 Neuse River Basinwide Assessment report by DWQ at [www.esb.enr.state.nc.us/Basinwide/NEU2000.pdf](http://www.esb.enr.state.nc.us/Basinwide/NEU2000.pdf).)

In summary, 6, or 29%, of the 21 rated streams were rated “good” or “excellent.” It is desirable for this percentage to increase to 100%.

#### **4. Total number of violations of maximum contaminant levels in public water supply**

Drinking Water and Health Advisory summary tables are prepared periodically by the U.S. Environmental Protection Agency (EPA). They contain drinking water standards in the form of non-enforceable concentrations of drinking water contaminants, or Maximum Contaminant Level Goals (MCLGs); enforceable Maximum Contaminant Levels (MCLs); and Health Advisories (HAs). Maximum Contaminant Levels are the maximum permissible level of a contaminant in water delivered to users of a public water system. Health Advisories (HAs) provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. The list of contaminants that EPA regulates can be found at [www.epa.gov/safewater/mcl.html](http://www.epa.gov/safewater/mcl.html).

Every community water supplier must provide an annual report (sometimes called a consumer confidence report) to its customers. The report provides information on local drinking water quality, including the water's source, the contaminants found in the water, and how consumers can get involved in protecting drinking water. Durham's report, which includes a listing of the maximum concentrations of regulated contaminants in Durham's water supply and the exceedances (or violations of MCLs), is available on the City of Durham's web site at [www.ci.durham.nc.us/departments/environ/water\\_quality.asp](http://www.ci.durham.nc.us/departments/environ/water_quality.asp). There were no violations of MCLs in the City of Durham's water supply in 2001. The goal is to keep this number at zero.

Note that many citizens of Durham County get their drinking water from private wells or community systems. The type of information that is available for Durham's public water supply is not available for private wells and community systems.

#### **5. Annual per capita pounds of nitrogen discharged by public wastewater treatment plants to streams in the county**

One of the foremost water-quality concerns in North Carolina is eutrophication of our lakes and estuaries. Eutrophication is caused by an excess of phosphorus and nitrogen in surface waters. These nutrients come from point sources (wastewater treatment facilities) and from nonpoint sources (runoff from the land). Phosphorus is highly regulated in North Carolina, and most studies indicate that nitrogen is the nutrient of concern for both lakes and estuaries. Eutrophication results in the excessive growth of aquatic algae. These algae can cause taste and odor problems in drinking water supplies and can lead to fish kills in lakes and estuaries.

There are three public wastewater treatment plants in Durham County. The City operates the South Water Reclamation Facility, which discharges to New Hope Creek and has a permitted discharge of 20 million gallons per day (MGD), and the North Water Reclamation Facility, which discharges to Ellerbee Creek and has a permitted capacity of 20 MGD. The County operates the Triangle Wastewater Treatment Plant, which has a permitted discharge of 12 MGD to Northeast Creek.

Based on a countywide 2001 population of 228,086 (<http://demog.state.nc.us/demog/cert01pa.html>) and a total discharge of 342,533 pounds in 2001, the total per capita pounds of nitrogen discharged by the 3 wastewater treatment plants in Durham County in 2001 was 1.50 pounds of nitrogen per person. It is desirable that this number decrease over time.

Other sources of nitrogen to streams in Durham County include upstream wastewater treatment plants, privately operated point sources, and nonpoint source runoff. Nonpoint sources can be as large or larger contributors of nitrogen to surface waters as point sources, but good estimates of nonpoint source loadings are difficult to obtain.

## Solid Waste

### **6. Municipal solid waste and construction and demolition waste originating anywhere within Durham County that ends up either landfilled or incinerated, measured in tons per capita**

The current rate at which Durham residents and employees discard solid waste is unsustainable in the longterm. Durham will ultimately be vying with other jurisdictions for the fewer and fewer parcels available for landfills on the East Coast. Landfill costs will be very high due to the scarce supply and high demand, and transportation costs will increase as ever more distant landfills are used.

Recycling and other waste reduction programs have reduced the per capita rate of discards over the last ten years, but Durham County still landfills approximately one ton of material per year per resident. Much of this landfilled material can be composted, recycled, or reused.

The Solid Waste Section of the Division of Waste Management of the North Carolina Department of Environment and Natural Resources calculates the tons of municipal solid waste and construction and demolition waste landfilled and incinerated from each county on an annual basis. These calculations also include a per capita figure, and they are obtainable from the Solid Waste Section website: [www.enr.state.nc.us/html/data.html](http://www.enr.state.nc.us/html/data.html).

The desirable trend is a steady reduction in the per capita tons of solid waste landfilled and incinerated.

During fiscal year 2001, 1.07 tons per capita were landfilled. No waste was incinerated.

**7. Total tons municipal solid waste and construction and demolition waste originating anywhere within Durham County that ends up either landfilled or incinerated each year**

If we are successful in significantly reducing the tons of waste generated per capita, while at the same time our population increases dramatically, the capacity of the environment to absorb our waste will still be taxed. For that reason, it is useful to know how the county is doing with regard to total tons of waste generated.

Again, the data are readily obtainable from the website furnished above. A downward trend in this number is desirable.

During fiscal year 2001, 238,894 tons were landfilled from Durham County.

**8. Number of employers within Durham County with ISO 14001 certification.**

Non-residential solid waste accounts for approximately 75% of the waste landfilled from within Durham County. Businesses that adopt environmental management systems pay greater attention to their waste production, among other environmental impacts. ISO 14001 is an internationally recognized environmental management system established by the International Organization of Standardization, and it is gaining acceptance in the Triangle region. ISO 14001 is a systematic way for a facility to continuously address the immediate and long-term impacts of its products, services, and processes on the environment. Businesses and local governments that officially adopt this method of environmental management are certified by the International Organization of Standardization.

The North Carolina Department of Environment and Natural Resources has adopted a policy to support and encourage adoption of environmental management systems by facilities in North Carolina. Its Division of Pollution Prevention and Environmental Assistance lists ISO 14001 certified facilities within the state as part of this effort. This information is available from its website at [www.p2pays.org/iso/certifac.asp](http://www.p2pays.org/iso/certifac.asp).

An upward trend in the number of these facilities would be a positive development.

The number of these facilities located in Durham County as of July 2002 is 3.

## Toxics

### **9. Total pounds of toxics released to the soil, air, and water as reported to the US EPA**

This indicator was chosen because it provides a simple and readily available method for quantifying toxic pollutant releases to the environment. The data are currently being collected from industrial facilities in the county and compiled each year by the US Environmental Protection Agency, thus the data are easily obtained at [www.epa.gov/triexplorer/chemical.htm](http://www.epa.gov/triexplorer/chemical.htm). Volumes are estimated by each facility and independently verified by US EPA auditors. The desired trend is for a reduction in all releases to the environment. Total releases of toxic chemicals by all facilities in Durham County for 2000 is 171,251 pounds.

### **10. Number of open cases regarding underground storage tank incidents**

Until the mid-1980's, most underground storage tanks for petroleum products were made of bare steel, which is likely to corrode over time and allow tank contents to leak into the environment. According to the U.S. Environmental Protection Agency, the greatest potential hazard from a leaking underground storage tank is that the petroleum or other hazardous substance can seep into the soil and contaminate groundwater. A leaking tank can also present other health and environmental risks, including the potential for fire and explosion. Federal and state regulations require the detection and clean-up of underground storage tank leaks. The North Carolina Department of Environmental and Natural Resources keeps a database of releases, or incidents, involving these tanks and their subsequent clean-up. The database is regularly updated and is accessible from a website: <http://ust.ehnr.state.nc.us/database.html>.

The desired goal is for the number of open incidents in Durham County to fall steadily toward zero. The current number of open cases is 356.

## Biodiversity

### **11. Number of years since last county inventory of plant communities.**

Biodiversity, or biological diversity, is the term for the variety of life and the natural processes of which living things are a part. This includes variety at the chromosome level, at the organism level, and the ecosystem level. Biodiversity is important for several reasons, including the following:



- The complex interdependence between organisms provides the stability that allows humans to thrive on the planet. Serious disruption of this complex system can occur unintentionally by humans, who do not have the capacity to understand the interaction between all of creation.
- The natural world is the source of many new medicines and food that could prove significant to human health. New discoveries in this field are being made on a regular basis.
- Our economic system is dependent upon raw materials that come from nature.
- Natural systems and their plant and animal life provide beauty and joy.

Durham's growth in population and the accompanying residential and commercial development activities threaten many of the area's biological and natural communities. A regular inventory of botanical life in the county is vital for documenting changes in their populations. Updated information is also a mechanism for taking into account newly discovered habitats and updated species information. This information helps identify which sites deserve and require protection, which is crucial to responsible local government planning.

A botanical inventory was conducted in Durham County in 1985. Dating from the base year 2001, this research was compiled 16 years ago. Numerous species have since been added to the state's listing of rare or uncommon species that would not have been noted during this earlier effort. More frequent inventories are desirable.

## **12. Number of years since last county inventory of amphibians, reptiles, nesting birds, and mammals**

See the biological diversity discussion under #11 above. A regular inventory of zoological life in the county is vital for documenting changes in their populations. Updated information is also a mechanism for taking into account newly discovered habitats and updated species information.

A zoological inventory was conducted in Durham County in 1994. Dating from the base year 2001, this research was compiled 8 years ago. It is desirable for this number to decrease.

# **Transportation**

## **13. Bus passenger trips per capita**

Use of mass transit reduces the combustion of fossil fuels by individual passenger vehicles, thus reducing emission of the following types of air pollutants:

- carbon dioxide (CO<sub>2</sub>), which contributes to global climate change;
- nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs), which combine to create smog;
- particulate matter, which causes lung irritation and reduces the body's ability to fight respiratory infections;
- toxics that have been linked to birth defects; and
- carbon monoxide (CO), which interferes with oxygen transportation in the blood.

The Durham Area Transit Authority (DATA) keeps track of the number of DATA bus passenger trips per year. There were 3.75 million passenger trips in 2001. It is desirable for this number to increase, but it is more important that the number increase relative to the number of county residents. The official State of North Carolina estimated population of Durham County in 2001 was 228,086 (<http://demog.state.nc.us/demog/cert01pa.html>). The number of bus passenger trips per capita in 2001 was therefore 16.44.

#### **14. Percent of total bike path miles designated in the current Long-Range Transportation Plan and Trails and Greenways Master Plan that have been built**

Bike paths facilitate and encourage bicycling as an alternative to vehicle use, thus reducing air pollution and use of fossil fuels.

The Durham Trails and Greenways Master Plan 2001 and the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization's current Long-Range Transportation Plan set goals for construction of public bike lanes and off-road trails within the county. The Durham City-County Planning Department has calculated this total combined mileage goal as 274.14 miles, and the number of these miles actually built as 17.8.

The foregoing two plans also set goals for paved shoulders suitable for bicycling. There are no data regarding how many miles of these paved shoulder currently exist, however, so these miles were not included in the indicator.

It is desirable that this percentage number rise quickly to 100 percent. The current percent of designated public bike lanes and off-road trails actually built is 6.5.

#### **15. Percent of covered employers in compliance with Durham's Commute Trip Reduction Program**

The Durham County Board of Commissioners established by ordinance a Commuter Trip Reduction program, effective as of July 2000. The ordinance states that “it is recognized that the reduction of single occupancy vehicle use, especially during peak hours, is an important goal for the entire Durham County community in order to reduce congestion on the highways and to reduce the levels of ozone in the air.”

The ordinance requires that all employers of more than 200 employees submit a travel reduction plan to the Triangle Transit Authority by December 31, 2001. (By December 31, 2002, all employers of more than 100 employees are required to submit a plan.) The plan must identify a transportation coordinator, describe how the employer is distributing alternative transportation option information to every employee, and describe measures designed to reduce employee commute trips, such as preferential parking for carpools, provision of vans, and subsidized bus fares. The covered employers must also conduct annual transportation surveys of employees and set goals for reducing single occupant vehicle use and the overall number of vehicle miles traveled.

The ordinance specifies that the covered employers’ annual survey of employees must represent at least 65% of the employer’s employees. According to the Triangle Transit Authority, there were 45 covered employers (i.e., employers with more than 200 employees) in 2001, and all of them submitted travel reduction plans. Only 70% of them, however, surveyed 65% or more of their employees. It is desirable that this number rise to 100%.

## Energy

### **16. Total number of solar installations reported as part of the Million Solar Roofs Initiative**

The Million Solar Roofs Initiative was initiated by the U.S. Department of Energy in 1997 to install solar energy systems on one million buildings in the United States by 2010. These systems include photovoltaics that produce electricity from sunlight and solar thermal systems that produce heat for domestic hot water, space heating, or swimming pools. Use of solar energy systems displaces burning of fossil fuels that create emissions that are harmful to human health and that contribute to global warming.

In North Carolina, the State Energy Office and the North Carolina Solar Center have taken a leadership role in the Million Solar Roofs Initiative and promoting solar installations. The Cooperative Extension Service office in Durham County has agreed to partner with these state agencies in this effort, and it is gathering data on buildings located in Durham County that have solar energy systems.

The more buildings with solar energy systems, the less negative will be the impact of the built environment on air quality and global warming. The current number of buildings in Durham County with solar energy systems is 107.

#### **17. Number of alternative fuel vehicles registered with the Triangle Clean Cities Coalition**

Alternative fuel vehicles use fuels such as compressed natural gas, ethanol, propane, electricity, and biodiesel. All of these fuels reduce harmful local air emissions and promote long term sustainability by reducing dependence on nonrenewable and imported transportation fuels. Ethanol and biodiesel can be produced in North Carolina from agricultural products and animal fat. Local businesses, government agencies, and individuals can all have an impact on air quality as well as national security and the local economy by choosing to purchase alternative fuel vehicles.

The Triangle Clean Cities Coalition is a voluntary group of public and private entities dedicated to increasing the use of alternative fuel vehicles in the Triangle region. Its institutional home is Triangle J Council of Governments, and it encourages owners of alternative fuel vehicles to register with the Coalition in order for the Coalition to keep track of the alternative fuel vehicle market in the region. Information on the number of these vehicles in Durham County registered with the Coalition is available by contacting the Coalition through its website at [www.trianglecleancities.org](http://www.trianglecleancities.org).

An increase in the number of alternative fuel vehicles in Durham County should have a positive effect on the environment. The current number of these vehicles is miniscule compared to the number of vehicles registered in the county, but as the number of alternative fuel vehicles increases, a better environmental indicator will be the percentage of registered vehicles that are alternative fuel vehicles.

The current number of alternative fuel vehicles registered in Durham County is 64.

#### **18. Number of public access stationary and mobile refueling stations for alternative fuel vehicles**

Without an infrastructure for refueling alternative fuel vehicles, these vehicles will never be a significant portion of the registered vehicles in the county. Several businesses and government agencies have refueling stations for their fleets, but such stations are currently not comparable to gasoline stations with regard to public accessibility.

The Triangle Clean Cities Coalition keeps track of the number of public access refueling stations in the Triangle region. See the previous indicator for a description of this organization and its website.

The more such refueling stations in the county, the more people will be able to use alternative fuel vehicles on a regular basis. The current number of these refueling stations in the county is zero.

## **APPENDIX—Environmental Indicators Summary**

A large number of indicators were considered for each of the chosen categories. After much consideration and discussion, the list of indicators was reduced to those presented in the body of the report. However, for completeness and to aid in future discussions about appropriate and meaningful indicators, the entire original list of indicators is presented in this Appendix. Note that this is an unedited list representing the thinking of individual Environmental Affairs Board members who undertook the task of developing indicators for particular categories.

The Board was particularly disappointed that it was not able to identify good existing data on which to base environmental indicators related to public health. This is one of several important areas for which environmental indicators should be developed in the future.

<b>Description</b>	<b>Possible unit of measurement</b>
<b>Air Quality</b>	
Ozone standards	Annual number of standard exceedances
Ozone levels	National ranking
Particulate matter	Annual number of exceedances of PM2.5 24-hour standard
Carbon monoxide	Annual number of exceedances of 8-hour standard
Greenhouse gas emissions	Tons of carbon equivalent of CO2, methane, and NOx
<b>Water Quality</b>	
Dissolved oxygen in surface waters	Ratio of number of violations to number of measurements
Turbidity in surface waters	Ratio of number of violations to number of measurements
Fecal coliform in surface waters	Ratio of number of violations to number of measurements
Nonpoint source loadings of sediment, nitrogen, bacteria, and BOD	Annual estimated loadings in pounds
Sediment/erosion control ordinance	Number of violations of maximum contaminant levels
Wetlands	Net change in wetland acreage, including restored/created wetlands
Floodplain management	Number of structures added to floodplain
Floodplain management	Number of structures removed from floodplain
Stream buffers	Miles of streams with 100 ft or greater buffers
Monitoring effectiveness	Percentage of stream miles with benthic ratings
Water supply	Groundwater use relative to recharge
Drinking water quality	Incidences of water-borne illnesses
Watershed protection	Acres developed in critical area
Water use	Gallons per capita
Effluent limit violations	Number
Facilities identified as "significant noncompliance"	Number
Pump stations and sewer lines	Number and volume of spills
Wastewater discharge	Gallons discharged per capita
Wastewater re-use	Percentage of total wastewater re-used
<b>Solid Waste</b>	
Delivery of Durham County waste to landfills and incinerators outside of Durham County	Miles per year driven by transfer trucks
Use of reused material or material with recycled content products by City and County government	Percent of total City and County purchase dollars used for reused or recycled content products
Durham Co. material reuse or recycling operations	Percent of employees in Durham Co. employed in reuse/recycling

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<b>Description</b>	<b>Possible unit of measurement</b>
<b>Toxics</b>	
Facilities required to report information to the US EPA under the EPCRA.	Total Number
Chemicals recycled by all facilities in county	Pounds per capita
Chemicals obtained through energy recovery by all facilities in county	Pounds per capita
Chemicals treated by all facilities in county	Pounds per capita
<b>Biodiversity</b>	
Plant and animal species documented in County that are rated critically imperiled, imperiled, or rare/uncommon.	Number of plants and animals
Greenspace protected, by ownership or ordinance	Acres per capita
Loss of greenspace	Acres per year
Important habitats irreparably impacted or converted to development	Acres
Important natural areas gaining increased protection.	Acres per year
Connectivity of greenspace	Percent of greenspace connected by functional wildlife corridors
Impervious surface coverage	Acres per year
Capacity of stormwater operational BMPs	Acres
Habitat restoration	Acres restored or under restoration
<b>Public Health</b>	
Incidence of acute and chronic respiratory illnesses	Number per year per 100,000 population
Incidence of lead poisoning, especially highly elevated levels	Number per year per 100,000 population
Incidence of pesticide poisoning	Number per year per 100,000 population
Incidence of asbestos related exposures	Number per year per 100,000 population
Incidence of carbon monoxide poisoning	Number per year per 100,000 population
Incidence of lung cancer and its association with tobacco smoke	Number per year per 100,000 population
Community and workplace efforts to address hearing protection	Unknown
Noise-induced hearing loss	Number of incidences

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<b>Description</b>	<b>Possible unit of measurement</b>
Incidence of food borne illnesses as a result of food consumption at home	Number per year
Incidence of food borne illnesses as a result of food consumption at business or work	Number per year
Quality of food establishments	Number of establishments that fail inspection
Effectiveness of emergency responsiveness to environmental incidents and disasters that directly impact public health	Unknown
Rodent and insect infestation	Number of reported incidences
Pollution prevention programs	Number of participating businesses
Environmental justice issues	Unknown
Public funding physical fitness programs	Number of programs per capita
Physically active population	Number of active population
Deaths due to respiratory illness	Deaths per 100,000 population
<b>Public Education</b>	
Circulation of "One's Trash"	Average quarterly circulation
News information releases about environment and government activity in the environmental arena	Number of news information releases by City and County government
Environmental information disseminated by Durham Soil and Water Conservation District	Number of pieces per year
Durham Soil and Water Conservation District Poster , Essay, and Speaking Contest Contest entries (by category)	Total number per year
Environmental education events conducted by Durham Soil and Water Conservation District, and by City and County Government	Total number per year
Attendance at environmental education events	Total number per year
Government staff attending environmental professional education sessions	Number of staff per year
Teachers receiving environmental training	Number of teachers per year
<b>Transportation</b>	
Pedestrian and bicyclist crashes	Annual number per 100,000 population
Sidewalk availability	Ratio of sidewalk miles to road miles

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<b>Description</b>	<b>Possible unit of measurement</b>
Financial incentives to commute by a high-occupancy-mode or telecommute	Percent of employees who work for major employers with incentives
<b>Land Use</b>	
Population per Small Area Plan unit	Annual percent change per small area
Rezoning compliance with adopted land use plans	Percent of rezonings in compliance with plan
Impervious surface coverage	Percent of county area
Activities of stream watch and highway adoption groups	Total miles of highway and streams with active groups

## **Durham City-County Environmental Affairs Board Members December 2002**

Each member is appointed by the City, the County, or the Soil and Water Conservation District Board to represent a specific background.

**William Anderson** was appointed by the City as the attorney representative. He graduated from the University of North Carolina at Chapel Hill in 1995 with a Bachelor of Arts in English and Political Science and from the University of North Carolina School of Law in 2000. He currently practices law at Newsom, Graham, Hedrick & Kennon, P.A. in the areas of real estate and land use.

**Jerad Bales** was appointed by the County as the engineering representative. He has a Ph.D. in civil engineering, with an emphasis in water resources, from the University of Texas. He has worked for the U.S. Geological Survey for 15 years and has published more than 100 papers and reports on various aspects of surface-water quantity and quality. He has received the U.S. Department of Interior's Superior Service Award and sits on a number of national-level policy and technical committees.

**Kathi Beratan** was appointed by the County to represent public policy. She has a Ph.D. in Geology from the University of Southern California. She is currently a Research Scientist at Duke University's Nicholas School of the Environment and Earth Sciences. Her research focuses on strategies to more effectively connect scientific inquiry to real-world environmental management and problem-solving efforts, with a particular focus on public participation and adaptive management approaches. She is Chair of the Sustainable Pennsylvania Program of the Pennsylvania Consortium for Interdisciplinary Environmental Policy, which is leading a cooperative effort to encourage, inform, and coordinate sustainable decision making at state and local levels.

**Ahrash Bissell** was appointed by the City to represent biological sciences. He is employed as an instructor and research associate in biology at Duke University and as an instructor of biology at Vance-Granville Community College. He received a Ph.D. in biology from the University of Oregon with an emphasis on evolutionary genetics, speciation, and conservation biology. He is particularly interested in the interface of research in biology and land-use policy, and he is active in several educational and outreach organizations in Durham, particularly those that are working to improve open spaces and alternative transportation in order to reduce our need for cars.

**Ray Eurquhart** was appointed by the Soil and Water Conservation District Board to represent land resources. He is employed by the City of Durham as a Plant Maintenance Mechanic in the Environmental Resources Department. He serves as a Durham County Supervisor to the Soil and Water Conservation District, and he is Secretary-Treasurer and Chief Shop Steward of the Durham City Workers' Union. He also serves on the board of S.E.E.D.S. (South Eastern Efforts Developing Sustainable Spaces), which develops community greening (gardening, open spaces and play lots) and models of environmental education for "inner city" youth, involving both the African American and Latino(a) community.

**Joe Jackson** was appointed by the City to represent water resources. He is currently serving as an Assistant Director of the Facilities Management Department at Duke University. He has been at Duke University for eight years. Prior to coming to Duke, he served as a Landscape Planner and Assistant Park Superintendent for the City of Winston-Salem for seven years. He is a graduate of the University of Wisconsin-Madison. He is also a registered Landscape Architect in the State of Indiana and was the owner/president of a design-build firm in that state for six years. He has active membership in several professional and civic organizations.

**Marian Johnson-Thompson** was appointed by the County to represent public health. She is Director of Education and Biomedical Research Development at the National Institute of Environmental Health Sciences, National Institutes of Health. She received the PhD in molecular virology from Georgetown Medical School and is adjunct professor in the School of Public Health, UNC-Chapel Hill. In addition to her professional work that focuses on research and training in health disparities and K-12 environmental health sciences education, she is also interested in emerging and reemerging infectious agents of environmental import and bioterrorism issues.

**Judy Kincaid** was appointed by the City to represent solid waste. She is the Solid Waste/Materials Resources Program Manager at Triangle J Council of Governments. She has twelve years experience developing innovative studies and programs aimed at reducing the production of solid waste in the Triangle region. She has received national and international recognition for her work in industrial byproduct exchanges and sustainable construction practices. She has a Bachelor of Arts in economics from the University of Michigan and a law degree from Catholic University. She formerly practiced and taught law in North Carolina for sixteen years.

**Samantha Miller** was appointed by the County as the air quality representative. She is employed by Onyx Environmental Services in Creedmoor, NC, an environmental service company dealing with removal and disposal of hazardous and problem wastes. She is a field supervisor involved with managing, packaging, and transporting hazardous waste. She graduated from Northland College, Ashland, WI with a BS in environmental studies with an emphasis in chemistry and biology. She recently moved to Durham and in the past has served on a recycling board for the City of Anoka, MN and the Consumer Advisory Panel for Northern States Power in Minneapolis, MN.

**Greg Pagett** was appointed by the City as the energy representative. He is a registered professional engineer with over 25 years experience, the last ten as a Senior Program Manager for Pacific Environmental Services in Research Triangle Park. He has a Masters in Civil Engineering and Bachelors in Chemical Engineering, both from North Carolina State University. He is a published author of papers related to both air and water quality concerns, and has led a wide variety of environmental and engineering evaluation, assessment, design, construction, and oversight projects.

**Dock Terrell** was appointed by the County as the education representative. He has an A.A.S. in Biotechnology. He is employed at the US EPA as an engineering technician with emphasis in inhalation toxicology and has more than 20 years experience in the field. He has co-authored a number of papers on disinfectant by-products with the Society of Toxicology. He has served on a number of county committees and is a longtime mentor/tutor at Fayetteville Street School. His latest award was recognition by the US EPA for Excellence in Response for work done after the Sept. 11, 2001 terrorist attack on New York City.